Claims

1. A method for an arithmetic encoding and decoding of binary states,

characterized in that

in a first step a presetable value range for the specification of the interval width R is separated in K representative interval widths $\{Q_1, \ldots, Q_K\}$, a presetable value range for the specification of the probabilities is separated in N representative probability states $\{P_1, \ldots, P_N\}$ and allocation regulations are given, which allocate one Q_K $(1 \leq k \leq K)$ to every interval width R and one P_n $(1 \leq n \leq N)$ to every probability, and that in a second step the encoding or decoding of the binary states take place by performing the calculation of the new interval width to be derived in the encoding or decoding process, respectively, using a representative interval width Q_K $(1 \leq k \leq K)$ and a representative probability state P_n $(1 \leq n \leq N)$ by arithmetic operations other than multiplication and division, wherein the representative interval width Q_K is determined by the basic basis interval of the width R and the representative probability state P_n is determined by the probability estimation underlying the symbol to be encoded or to be decoded according to the given allocation regulations.

2. The method according to claim 1,

characterized in that

based on the interval currently to be evaluated having a width R, for determining the associated interval width Q_K, an index q_index is determined by a shift

and bit masking operation applied to the computer-internal/binary representation of R.

3. The method according to claim 1,

characterized in that

based on the interval currently to be evaluated with a width R, for the determination of the associated interval width Q_K, an index q_index is determined by a shift operation applied to the computer-internal/-binary representation of R and a downstream access to a table Qtab, wherein the table Qtab contains the indices of interval widths corresponding to values of R prequantized by a shift operation.

4. The method according to claim 1,

characterized in that

the probability estimation underlying the symbol to be encoded or to be decoded is associated with a probability state P_n with the help of an index p_state.

5. The method according to claim 1,

characterized in that

the values of the interval width R_{LPS} corresponding to all K interval widths and to all N different probability states are entered into a table Rtab as product values (Q_K * P_n).

6. The method according to claim 1,

characterized in that

the determination of the interval width R_{LPS} corresponding to the LPS is performed by an access to a table Rtab, wherein the table Rtab contains the values of the interval width R_{LPS} corresponding to all K quantized values of R and to the N different probability states as product values ($Q_K * P_n$).

7. The method according to claim 1,

characterized in that

the determination of the interval width R_{LPS} corresponding to the LPS is performed by an access to the table Rtab, wherein, for an evaluation of the table, the quantization index q_index and the index of the probability state p_state are used.

8. The method according to claim 1,

characterized in that

for the N different representative probability states transition rules are preset, wherein the transition rules indicate which new state is used for the next symbol to be encoded or to be decoded based on the currently encoded or decoded symbol.

9. The method according to claim 8,

characterized in that

a table Next_State_LPS is created which contains the index m of the new probability state P_m for the index n of the currently given probability state P_n at the occurrence of a least probable symbol (LPS).

10. The method according to claim 8,

characterized in that

a table Next_State_MPS is created which contains the index m of the new probability state P_m for the index n of the currently given probability state P_n at the occurrence of a most probable symbol (MPS).

11. The method according to claim 1,

characterized in that

the number K of quantization values and/or the number N of the representative states are selected depending on the preset accuracy of the coding and/or depending on the available storage room.

12. The method according to claim 1,

characterized in that

the table-aided encoding includes the following steps:

6. Determination of the LPS
7. Quantization of R:
   q_index = Qtab[R>>q]
8. Determination of R_{LPS} and R:
   R_{LPS} = Rtab [q_index, p_state]
   R = R − R_{LPS}
9. Calculation of the new partial interval:
   if (bit = LPS) **then**
   - **L ← L + R**
   - **R ← R_{LPS}**
   - **p_state ← Next_State_LPS [p_state]**
   - **if (p_state = 0) then valMPS ← 1 − valMPS**

   else
   - **p_state ← Next_State_MPS [p_state]**
10. Renormalization of L and R, writing bits, wherein
    q_index describes the index of a quantization value read out of Qtab,

p_state describes the current state,

R_{LPS} describes the interval width corresponding to the LPS and

valMPS describes the bit corresponding to the MPS.

13. The method according to claim 1,

characterized in that

a table-aided decoding includes the following steps:

1. Determination of the LPS
2. Quantization of R:
   q_index = Qtab[R>>q]
3. Determination of R_{LPS} and R:
   R_{LPS} = Rtab [q_index, p_state]
   R = R - R_{LPS}
4. Determination of bit depending on the position of the partial interval:
   if (V ≥ R) **then**
       bit ← LPS
       V ← V - R
       R ← R_{LPS}
       if (p_state = 0) then valMPS ← 1 - valMPS
       p_state ← Next_State_LPS [p_state]
   else
       bit ← MPS
       p_state ← Next_State_MPS [p_state]
5. Renormalization of R, reading out one bit and updating V, wherein

q_index describes the index of a quantization value read out of Qtab,

p_state describes the current state,

R_{LPS} describes the interval width corresponding to the LPS,

valMPS describes the bit corresponding to the MPS, and

V describes a value from the interior of the current partial interval.

14. The method according to claim 1,

characterized in that

in encoding and/or decoding the calculation of the quantization index q_index is performed in the second substep according to claim 12 and/or 13 according to the calculation regulation:

q_**index** = (R >> q) & Qmask

wherein Qmask illustrates a bit mask suitably selected depending on K.

15. The method according to claim1,

characterized in that

when a uniform probability distribution is present

in the encoding according to claim 12 the substeps 1 to 4 are performed according to the following calculation regulation:

$\mathbf{R} \leftarrow \mathbf{R} \gg \mathbf{1}$

if (bit = 1) **then**

  $\mathbf{L} \leftarrow \mathbf{L} + \mathbf{R}$

or

that the substeps 1 to 4 of the encoding according to claim 12 are performed according to the following calculation regulation:

$\mathbf{L} \leftarrow \mathbf{L} \ll \mathbf{1}$

if (bit = 1) **then**

  $\mathbf{L} \leftarrow \mathbf{L} + \mathbf{R}$

and wherein in the last alternative the renormalization (substep 5 according to claim 12) is performed with doubled decision threshold values and no doubling of L and R is performed, and

that in the decoding according to claim 13 the substeps 1 to 4 are performed according to the following calculation regulation:

R ← R >>1

if (V ≥ R) **then**

  bit ← 1

  V ← V − R

else

  bit ← 0,

or

the substeps 1 to 5 of the decoding according to claim 13 are performed according to the following calculation regulation:

3. Reading out one bit and updating V
4. Determination of bit according to the position of the partial interval:

if (V ≥ R) **then**

  bit ← 1

  V ← V − R

else

  bit ← 0.

16. The method according to claim 1,

characterized in that

the initialization of the probability models is performed depending on a quantization parameter SliceQP and preset model parameters m and n, wherein SliceQP describes the quantization parameter preset at the beginning of a slice and m and n describe the model parameters.

17. The method according to claim 1,

characterized in that

the initialization of the probability models includes the following steps:

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1.  preState = min(max(1, ((m * SliceQP) >>4)+n), 2*N)
2.  if (preState <=N) then
        p_state = N+1 - preState
        valMPS = 0
    else
        p_state = preState - N
        valMPS = 1,
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wherein valMPS describes the bit corresponding to the MPS, SliceQP describes the quantization parameter preset at the beginning of a slice and m and n describe the model parameters.

18. The method according to claim 1,

characterized in that

the probability estimation of the states is performed using a finite state machine (FSM).

19. The method according to claim 1,

characterized in that

the generation of the representative states is performed offline.

20. The method according to claim 1,

characterized in that

the selection of the states depends on the statistics of the data to be coded and/or on the number of states.

21. An arrangement having at least one processor and/or chip, which is/are implemented such that a method for an arithmetic encoding and decoding of binary states is may be performed, wherein

in a first step a presetable value range for the specification of the interval width R is separated in K representative interval widths $\{Q_1, \ldots, Q_K\}$, a presetable value range for the specification of the probabilities is separated in N representative probability states $\{P_1, \ldots, P_N\}$ and allocation regulations are given, which allocate one Q_K $(1 \leq k \leq K)$ to every interval width R and one P_n $(1 \leq n \leq N)$ to every probability, and wherein in a second step the encoding or decoding of the binary states take place by performing the calculation of the new interval width to be derived in the encoding or decoding process, respectively, using a representative interval width Q_K $(1 \leq k \leq K)$ and a representative probability state P_n $(1 \leq n \leq N)$ by arithmetic operations other than multiplication and division, wherein the representative interval width Q_K is determined by the basic basis interval of the width R and the representative probability state P_n is determined by the probability estimation underlying the symbol to be encoded or to be decoded according to the given allocation regulations.

22. A computer program which enables a computer after it has been loaded into the storage of the computer to perform a method for an arithmetic encoding and decoding of binary states, wherein

in a first step a presetable value range for the specification of the interval width R is separated in K representative interval widths $\{Q_1, \ldots, Q_K\}$, a presetable value range for the specification of the probabilities is separated in N representative

probability states $\{P_1, \ldots, P_N\}$ and allocation regulations are given, which allocate one Q_K $(1 \leq k \leq K)$ to every interval width R and one P_n $(1 \leq n \leq N)$ to every probability, and wherein in a second step the encoding or decoding of the binary states take place by performing the calculation of the new interval width to be derived in the encoding or decoding process, respectively, using a representative interval width Q_K $(1 \leq k \leq K)$ and a representative probability state P_n $(1 \leq n \leq N)$ by arithmetic operations other than multiplication and division, wherein the representative interval width Q_K is determined by the basic basis interval of the width R and the representative probability state P_n is determined by the probability estimation underlying the symbol to be encoded or to be decoded according to the given allocation regulations.

23. A computer-readable storage medium on which a computer program is stored which enables a computer after it has been loaded into the storage of the computer to perform a method for an arithmetic encoding and decoding of binary states, wherein

in a first step a presetable value range for the specification of the interval width R is separated in K representative interval widths $\{Q_1, \ldots, Q_K\}$, a presetable value range for the specification of the probabilities is separated in N representative probability states $\{P_1, \ldots, P_N\}$ and allocation regulations are given, which allocate one Q_K $(1 \leq k \leq K)$ to every interval width R and one P_n $(1 \leq n \leq N)$ to every probability, and wherein in a second step the encoding or decoding of the binary states take place by performing the calculation of the new interval width to be derived in the encoding or decoding process, respectively, using a representative interval width Q_K $(1 \leq k \leq K)$ and a representative probability

state P_n ($1 \leq n \leq N$) by arithmetic operations other than multiplication and division, wherein the representative interval width Q_K is determined by the basic basis interval of the width R and the representative probability state P_n is determined by the probability estimation underlying the symbol to be encoded or to be decoded according to the given allocation regulations.

24. The computer program according to claim 22, which is downloaded from an electronic data network, like for example from the internet, onto a data processing means which is connected to the data network.